

# Slow Light Based On-Chip High Resolution Fourier Transform Spectrometer For Geostationary Imaging of Atmospheric Greenhouse Gases, Phase I

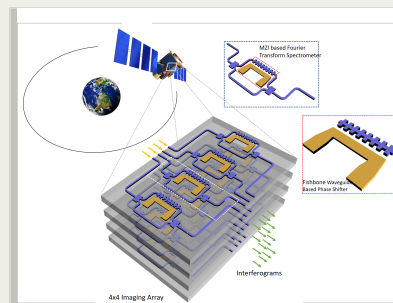
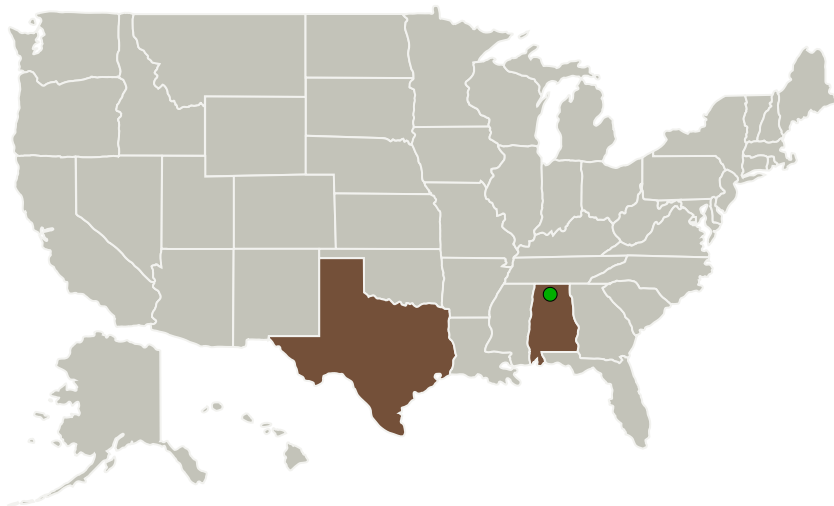
Completed Technology Project (2017 - 2017)



## Project Introduction

Fourier transform spectroscopy (FTS) in infrared wavelength range is an effective measure for global greenhouse gas monitoring. However, conventional FTS instruments are bulky, heavy, and frail to environmental vibration, making them not suitable for satellite platforms. In this proposal, Omega Optics, Inc., together with the University of Texas at Austin, proposes a slow light enhanced on-chip FTS array covering compound spectral wavelength range (1.1 ~ 6.2  $\mu\text{m}$ ) for geostationary imaging of greenhouse gases. Each array pixel is made of a Mach-Zehnder interferometer, one arm of which is conventional waveguide and the other is 'fishbone' slow light waveguide. Harnessing the nonlinear phase enhancement generated by the slow light effect of the 'fishbone' waveguide, a resolution better than 0.2  $\text{cm}^{-2}$  can be readily achieved within a limited chip surface. An  $N \times M$  array can be formed by integrating  $N$  pixels on one silicon-on-sapphire chip and stacking  $M$  chips. Leveraging the CMOS compatible fabrication process, the imaging unit can be  $\sim \$10$  per pixel and the whole imaging array weights  $\sim 30\text{g}$ . In addition, the whole module does not have moving parts, making it an ideal candidate for airborne and spaceborne applications.

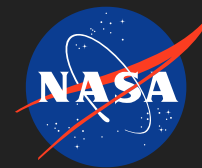
## Primary U.S. Work Locations and Key Partners



Slow Light Based On-Chip High Resolution Fourier Transform Spectrometer For Geostationary Imaging of Atmospheric Greenhouse Gases, Phase I Briefing Chart Image

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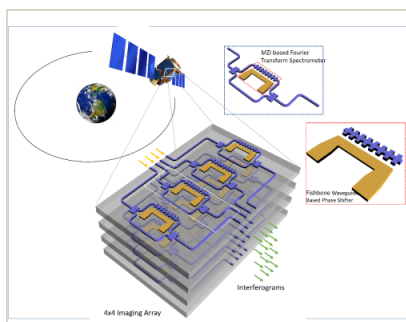
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Organizations Performing Work	Role	Type	Location
Omega Optics, Inc.	Lead Organization	Industry	Austin, Texas
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

## Primary U.S. Work Locations

Alabama	Texas
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## Images



### Briefing Chart Image

Slow Light Based On-Chip High Resolution Fourier Transform Spectrometer For Geostationary Imaging of Atmospheric Greenhouse Gases, Phase I Briefing Chart Image  
(<https://techport.nasa.gov/image/126145>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Omega Optics, Inc.

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

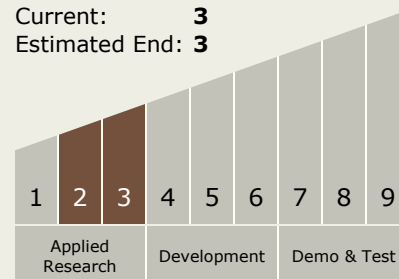
Carlos Torrez

### Principal Investigator:

Xiaochuan Xu

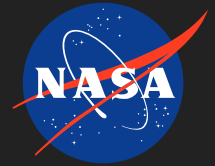
## Technology Maturity (TRL)

Start: 2  
Current: 3  
Estimated End: 3



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## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
    - └ TX08.1.3 Optical Components

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System